(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 December 2003 (18.12.2003)

PCT

(10) International Publication Number
WO 03/103409 A2

(51) International Patent Classification[7]: A23C 7/04, A23L 1/015, C12H 1/00, 1/04, A23L 2/70, 2/80

(21) International Application Number: PCT/EP03/06072

(22) International Filing Date: 10 June 2003 (10.06.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
MI2002A001260 10 June 2002 (10.06.2002) IT

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:
— *of inventorship (Rule 4.17(iv)) for US only*

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 03/103409 A2

(54) Title: NEW INDUSTRIAL PROCESS FOR FOOD LIQUIDS DECONTAMINATION FROM CHEMICAL AND/OR BIOLOGICAL CONTAMINANTS

(57) Abstract: Procedure for the decontamination of a food liquid from one or more chemical and/or biological contaminants, based on the contact of said liquid with at least a biocompatible membrane, to which antibodies specific for said contaminants are covalently bound.

gel, cellulose and derivatives thereof. However, the use of said techniques is limited as it effects an insufficient decontamination and, being based on nonspecific physical processes, removes substances, e.g. pigments, flavouring agents or even nutrients, which substantially determine the food primary characteristics.

Patent application MI99A002622 by the Applicant describes an innovative and ameliorative decontamination technique envisaging the complexation (elimination) of the toxic contaminants present in the food liquid by the corresponding insolubilised specific polyclonal antibodies.

In particular, immunoglubulins specific for the contaminant to be eliminated are insolubilised by adhesion to glass or plastic microspheres or to magnetised metal microspheres, optionally coated with chemically derivatizable polymers and added to the contaminated liquid in precise and predetermined molar concentration ratios. After incubation, the toxic residues-immunoglobulins complexes that form are eliminated by filtration.

However, some drawbacks are inherent in the industrial application of said technique:

a. the microspheres used as a means of immobilisation and utilisation of decontaminants, are precipitable. Therefore, the food liquid must be vigorously stirred. It follows that the process, which, moreover, is not always technically applicable, involves considerable modification costs;
b. since the surface of contact between the immunoglobulins and the liquid to be decontaminated is small, the decontamination time is relatively long and not always compatible with the production processes;
c. since the antibody is bound to the solid support by adhesion, i.e. through a weak bond, it tends to be detached therefrom in considerable amounts during the washing and reactivation steps, carried out to allow its use in successive processes. It follows that it cannot be reused as many times as needed not to significantly affect the production costs;
d. the liquid filtration required at the end of the process determines an increase in production times and costs.

Substrates of a different nature, e.g. membranes obtained in nitrocellulose or other physically reactive polymers, whereto immunoglobulins are bound by adhesion,

one end and by some balance weights at the other end. The membranes are kept immersed in the liquid to be decontaminated for a period preferably ranging from 1 to 24 hrs, depending on the contaminant concentration, on the temperature and on the presence or absence of stirring. The liquid decontamination is more rapid under stirring. According to the present invention, the food liquid can be completely and rapidly decontaminated also without stirring. This is particularly advantageous when the stirring of the liquid mass to be decontaminated is unadvisable or involves excessive costs.

Furthermore, the decontamination is more rapid at room temperature than at temperatures below room temperature. In fact, at room temperature, the decontamination preferably takes from 1 to 6 hrs.

Once the treatment has been completed, the membrane/s of the invention is/are separated from the liquid by simple removal, i.e. without the separation procedures, such as filtration, required by techniques known in the art. This brings about considerable advantages in terms of cost and safety.

The food liquids that can be decontaminated by the procedure according to the present invention are, e.g. wine, milk, fruit and vegetables juices, beer and water.

According to a particularly preferred embodiment of the present invention, the membrane/s consists/consist of a biocompatible polymer that is chemically conjugated with antibodies. The biocompatible polymer is synthetic, semi-synthetic or natural and is suitable for the preparation of a membrane with a mechanical resistance sufficient for the use of same in the claimed procedure.

Membranes are preferably in the form of woven or non-woven fabric

The polymer is preferably selected from the group consisting of nylon and derivatives thereof, cellulose derivatives and polyacrylates, nitrocellulose and nylon 66 being particularly preferred. Membranes can consist of only one of these materials or being prepared with a mixture of them (e.g. alcantara consists in 60% polyester and 40% polyurethane).Antibodies specific for the contaminant/s to be eliminated are immobilised on the membranes of the invention. Preferably, said antibodies are polyclonal antibodies, obtained by immunisation of medium-large sized animals according to methods known in the art (cf. A. Johnstone and Thorpe, Immunochemistry in Practice, 1982, 27-30, Blackwell Sci. Publ., Oxford).

The antibodies are immobilised on the membranes of the invention by chemical

the procedure of the invention offers many and unexpected advantages.

In particular, as demonstrated by the following examples, the procedure of the invention is of easier application since it does not require any stirring of the liquid. Furthermore, said procedure brings about a complete decontamination within a much shorter time than necessary for the procedure described in patent application MI99A002622, which – for the decontamination – utilises antibodies immobilised on microspheres. As shown in more details in Example 18, a further advantage of the present procedure is that the claimed membranes may be regenerated by contaminant removal by washing, e.g. with 0.1N HCl, and may be re-used in successive decontamination procedures, without losing their decontamination power. That brings about considerable advantages in terms of process costs.

Example 1

Preparation of atrazine-BSA (Bovine Serum Albumin) conjugate

1. Diazoderivative preparation

10 mg Atrazine (4.6×10^{-6} mol) was added with 10 µl 1N HCl (5×10^{-6} mol). The resulting mixture was brought to the desired consistency by means of a spatula, poured into a test tube, which was placed into boiling water, and added with 900 µl distilled water. The resulting atrazine•HCl solution was added with 0.5 ml 1N HCl and cooled in an ice bath. Once 1 mg NaBr was added, 260 µl $NaNO_2$ cold solution in a concentration of 1 mg/ml (260 mg; 4.4×10^{-6} mol) was added dropwise under stirring. Stirring was continued for 1 hr in ice to give the captioned diazoderivative.

2. Conjugation with BSA

A BSA solution in a concentration of 8.4 mg/ml in 0.1M borate buffer, pH 9, was added dropwise under stirring over a period of 15 min with the diazoderivative solution prepared as per point 1; the pH was maintained constant by addition of 1N NaOH. The mixture was caused to react in ice for 2 hrs and dialysed against PBS (Phosphate Buffered Saline).

Example 2

Preparation of aflatoxin-BSA conjugate

1. Preparation of benzidine bis-diazoderivative

Benzidine•2HCl (26 mg) was dissolved in 4.5 ml 0.2N HCl, added with 18 mg

dissolved in 1 ml of the said buffer containing DMSO in the final concentration of 0.06 M and, under stirring, with 25 mg powdered carbodiimide (CDI) (Sigma E1769). Stirring was continued at laboratory temperature for 1 hr, while the pH was controlled every 10 min and adjusted to 7.5 as long as necessary. The mixture was caused to react at 4°C overnight and successively dialysed against PBS to remove excess unreacted reagents.

A conjugate containing 0.93 mg BSA and 0.15 mg fumonisine B1/ml was obtained.

Example 5

Preparation of cadaverine-azo-BSA conjugate

Cadaverine: 1,5-diaminopentene [H_2N-$(CH_2)_5$-NH_2]

Conjugate: H_2N-$(CH_2)_5$-N=N-BSA

1. Preparation of cadaverine mono-diazoderivative

The reaction was performed in an ice bath.

Cadaverine dihydrochloride (35 mg; 0.2 mmol)) was dissolved in 5 ml water containing 0.3 mmol HCl and 4 mg NaBr (0.04 mmol).

The solution was slowly added over a period of approx. 10 min, under stirring, with 14.5 mg (0.21 mmol) $NaNO_2$ dissolved in 1 ml icy water.

Once the presence of excess HNO_2 was checked with iodine-starch treated paper, the reaction was continued for further 10 min to give [NH_2-$(CH_2)_5$-N=N-OH].

2. Preparation of cadaverine-azo-BSA conjugate

A BSA solution (10 ml) in a concentration of 10 mg/ml in 0.1M borate buffer, pH=9.0, containing 0.13M NaCl was added, under stirring and in an ice bath, with 2 ml cadaverine diazoderivative solution prepared as described above.

The resulting solution was caused to react under desultory stirring at 4°C for 2 hrs and then dialysed against PBS in 10 Kd cut-off tubing. The pH was then adjusted to 9.0.

The cadaverine/BSA conjugation ratio obtained was 23.5:1.

Example 6

Preparation of putresceine-azo-BSA conjugate

The putresceine-azo-BSA immunogen was synthesized as described in Example 6, in the same reaction molar ratios (by multiplying the amount indicated for cadaverine by 0.92).

Owing to structural analogy, the antibodies produced against cadaverine reacted

Example 9

Salmonella inactivation

For the production of antibodies against salmonella, the animal was sensitized using the relevant antigen.

The antigen was produced from the salmonella enteritidis pathogen taken from a clinico-pathological material and grown by fermentative route on a medium specific for salmonellas.

The antigen was extracted by bacterial lysis according to methods known (M. Raynaud, A. Turpin, R. Mangalo and B. Bizzini, Croissance et toxinogénèse, Ann. Inst. Pasteur, 1955, 88, 24).

The purification and transformation of same into an immunogen were carried out by traditional methods (B. Bizzini, A. Turpin and M. Raynaud, Bull. Inst. Pasteur, 1974, 72, 177).

Example 10

Animals immunisation for polyclonal antibodies production

The polyclonal antibodies corresponding to the various immunogens synthesised in Examples 1 to 9 were produced in the sheep according to a method already described (cf. A. Johnstone and R. Thorpe, Immunochemistry in Practice, 1982, 27-30, Blackwell Sci. Publ., Oxford).

In particular, the immunisation protocol adopted was as follows:

a. animal sensitisation treatment by subcutaneous (sc) administration of 10 mg immunogen/animal, suspended in 2 ml of a 1:1 (v/v) mixture of PBS, pH 7.4, and Freund complete adjuvant (Sigma F5881); the sc injection was administered in five different points (0.4 ml/point) of the animal dorsal region;

b. booster treatment by intramuscular (im) injection (in the thigh) of 2.5 mg immunogen/animal, suspended in 1 ml of a 1:1 (v/v) mixture of PBS, pH 7.4, and Freund's incomplete adjuvant (Sigma F5506);

c. booster treatments at thirty-day intervals, performed under the same experimental conditions as described above until antibody response positivity.

The antibody response positivity was assayed by the ELISA method: the microplate well was coated with a control immunogen, i.e. an immunogen of the same hapten conjugated with a protein (e.g. HSA; OVA) heterologous in respect of that used for the synthesis of the test immunogen (product administered). The

attack.

Reaction scheme:

Nitrocellulose-O-CH_2-CH_2-SO_2-CH=CH_2 + H_2N-$(CH_2)_4$-NH_2 ——>

Nitrocellulose-O-CH_2-CH_2-SO_2-CH_2-CH_2-NH-$(CH_2)_4$-NH_2

The activated nitrocellulose sheet prepared as described above was immersed in a 1% (w/v) water solution of 1,4-diaminobutane (Sigma P7505) at 21°C for 30 min, removed therefrom and washed with distilled water.

3. Immunoglobulins binding to cellulose

Immunoglubulins were bound to the nitrocellulose treated as described above by one of the two following techniques:

3a) IgGs periodic-oxidation and binding to the NH_2 group of the linker

10 ml of an IgG solution (20 mg/ml) in 0.1M citric acid/Na citrate buffer, pH 5.0, was heated to 37°C and added with a sodium metaperiodate solution ($NaIO_4$, 30 mg/ml water) in an IgG/sodium metaperiodate molar ratio equal to 1:15.

The oxidation was carried out at 37°C for 5 min, under stirring, sheltered from light, and discontinued by addition of ethylene glycol (Sigma E9129) in a final concentration of 0.01 M.

The linked nitrocellulose sheet, prepared as per point 2, was immersed in 40 ml 1M Na_2CO_3/$NaHCO_3$ buffer, pH 10.0, and added with the solution of oxidised IgGs. The reaction was carried out at 4°C overnight.

The pH was adjusted to 6.0 by addition of 1M NaH_2PO_4. Then, a fresh 0.26M $NaBH_4$ solution (10 mg/ml) was added to a final concentration of 0.001M. The reduction reaction was carried out at room temperature for 30 min.

The nitrocellulose sheet was washed with PBS, pH 7.4, and dried.

3b) Introduction of aldehydic groups on linked nitrocellulose and IgGs immobilisation

Reaction scheme:

Nitrocellulose-O-$(CH_2)_2$-SO_2-$(CH_2)_2$-NH_2 + -CHO-$(CH_2)_3$-CHO ——>

Nitrocellulose-O-$(CH_2)_2$-SO_2-$(CH_2)_2$-N=CH-$(CH_2)_3$-CHO

The nitrocellulose-NH_2 sheet prepared as per point 2 was immersed in a 1% (v/v) glutaraldehyde solution in 0.5M $NaHCO_3$/Na_2CO_3, pH 10, where it was kept at 21°C for 15 min, washed with distilled water and dried.

The resulting nitrocellulose sheet could be preserved at 4°C in the dry state for

Nylon-NH_2 + CHO-$(CH_2)_3$-CHO ——> Nylon-N=CH-$(CH_2)_3$-CHO

The nylon fabric, preactivated with HCl, was treated with a 2% glutaraldehyde solution in distilled water at room temperature for 2 hrs.

After washing with distilled water, the nylon fabric was treated at room temperature for 4 hrs with an IgG solution in PBS in a 1 mg/ml concentration. The fabric was then washed with PBS, treated with a 2% (w/v) OVA solution in PBS for 1 hr, further washed at room temperature with PBS-Tween 20 (0.05%), and dried.

2c)

Reaction scheme:

Nylon-NH_2 + CH_2=CH-SO_2-CH=CH_2 ——>

Nylon-NH-CH_2-CH_2-SO_2-CH=CH_2

The nylon fabric pretreated with HCl for reactive groups exposure, was immersed in 10 ml divinylsulfone (DVS) dissolved in 20 ml dimethylformamide (DMF) and 170 ml 0.5M $NaHCO_3/Na_2CO_3$ buffer, pH 9.0, where it was kept at 21°C for 1 hr, and washed with distilled water.

100 mg IgGs was dissolved in 20 ml 0.5M $NaHCO_3/Na_2CO_3$ buffer, pH 9.0. The nylon-DVS fabric was immersed in said solution where it was kept at room temperature overnight.

Once the reaction was completed, nylon was rinsed with PBS and dried.

Example 14

Wine decontamination from ochratoxin

The aim of the experiment was to analyse, in parallel, the complexation (elimination) capacity – and relevant rate – of anti-ochratoxin-specific immunoglobulins (IgGs) for wine decontamination from the toxin. The IgGs were used in the following forms:

a. free – as are, not bound to any support;

b. bound to microspheres made of glass containing primary aminic groups (Glass-aminopropyl - Sigma G4643 - 200/400 mesh);

c. bound to nylon fabric according to the present invention.

Immunoglobulins IgGs were bound to the glass microspheres according to the following reaction scheme:

5 mg anti-ochratoxin specific IgGs was diluted in 2 ml 0.01M acetate buffer, pH 5.5, and dialysed against said buffer (purification salts removal).

IgG-ochratoxin complexes present.

The following table shows the results obtained under the aforesaid experimental conditions, expressed as per cent abatement of the free toxin concentration in wine (decontamination capacity of the various toxin elimination systems by specific IgGs).

Method	Stirring at	% wine toxin abatement after		
		1h	3h	6h
Free IgGs	150 rpm	75	90	100
IgGs on glass microspheres	150 rpm	54	60	62
IgGs on nylon	150 rpm	95	100	—
Free IgGs	1000 rpm	84	95	100
IgGs on glass microspheres	1000 rpm	90	100	—
IgGs on nylon	1000 rpm	100	—	—

The results obtained show that:

a. using specific IgGs, wine can be completely decontaminated from ochratoxin;

b. using free IgGs, the time taken to complex the whole toxin is relatively long (probably due to the action of the interfering substances present in wine);

c. using IgGs bound to glass microspheres, a fairly vigorous stir is required to obtain total complexation, likely because, in the absence of or under gentle stirring, the microspheres tend to deposit on the bottom. However, vigorous stirring may be incompatible with the industrial wine-making process;

d. surprisingly, using IgGs conjugated with the fabric, the whole toxin present in wine can be complexed within short times and with low stirring levels completely compatible with the industrial process.

Example 15

Wine decontamination from biogenic amines (putresceine)

The aim of the experiment was to analyse the complexation (elimination) capacity – and relevant rate – of specific immunoglobulins for wine decontamination from biogenic amine, added extemporaneously to wine in predetermined

The following table shows the results obtained under the aforesaid experimental conditions, expressed as per cent abatement of the free biogenic amine concentration in wine (decontamination capacity of the various amine elimination systems by specific IgGs in different forms).

Method	Stirring	% toxin abatement after 1h	3h	6h
Free IgGs	no	55	65	80
IgGs on glass microspheres	no	50	55	58
IgGs on nylon	no	75	95	100
Free IgGs	150 rpm	72	87	100
IgGs on glass microspheres	150 rpm	65	70	74
IgGs on nylon	150 rpm	96	100	----

The results obtained show that:

a. surprisingly, using IgGs immobilised on nylon fabric, food liquids (wine) can be completely decontaminated also when allowed to stand, i.e. without stirring procedures, which might be hardly applicable to production processes;

b. IgGs immobilised on glass microspheres cannot exert their optimum decontamination power because, before total complexation, they tend to deposit on the bottom.

Example 16

Wine decontamination from carbamates (ethyl carbamate or urethane)

The capacity of IgGs – either free or variously immobilised on inert substrates at different concentration levels – for decontaminating wine from carbamate, added extemporaneously, was evaluated.

To that purpose, the following specific antiurethane immunoglobulins were used:

a. free –not immobilised on any support;

b. immobilised on glass microspheres (Sigma G4643) as described in the preceding examples;

IgGs on nylon	1	94	100	—

Considering that each mol of specific antibody can generally complex two antigen mols, the above results prove that the IgGs immobilisation on nylon fabric make IgGs surprisingly bioavailable for antigen binding; a proof is that, already at concentrations close to the theoretical values, the contaminant elimination from wine is almost total.

Example 17

Milk decontamination from aflatoxin

The aim of the experiment was to analyse the capacity – and relevant rate – of anti-aflatoxin specific IgGs immobilised on different inert supports for milk decontamination from aflotoxin A1. The IgGs were used in the following forms:

a. anti-aflotoxin specific IgGs immobilised on glass microspheres according to the procedure described in the preceding examples;

b. the same IgGs immobilised on nylon fabric according to the present invention.

The decontamination experiments were carried out on a sample maintained at 4°C, i.e. at the usual milk preservation temperature.

Decontamination was performed according to the following experimental procedure.

The aflatoxin A1 content in milk was determined by HPLC as known in the art (S.M. Lamplugh, Comparison of three methods for the extraction of aflatoxins from human serum in combination with a high-performance liquid chromatographic assay, J. Chromatogr., 1983, 273, 442). The method was adjusted according to the nature of the sample.

A milk lot was examined to ascertain the presence of toxin, if any. Then the milk was added with aflatoxin up to a final concentration of 0.3 µg/l milk and subdivided into 10 l aliquots, which were treated as follows:

aliquot No. 1: under stirring at 150 rpm, with addition of anti-aflatoxin IgGs immobilised on glass microspheres in a ratio of 1 mol IgG to 1 mol toxin present;

aliquot No. 2: under stirring at 150 rpm, with addition of anti-aflatoxin IgGs immobilised on nylon fabric in a ratio of 1 mol IgG to 1 mol toxin present;

aliquot No.3: under stirring at 150 rpm, with addition of anti-aflatoxin IgGs immobilised on glass microspheres in a ratio of 2 mol IgG to 1 mol toxin present;

to be re-used, once adequately washed, in successive treatments.

To this end, the analysis of milk decontamination from salmonella antigens was conducted with IgGs in the following forms:

a. free – as are, non-immobilised on any support;

b. immobilized on glass microspheres (Sigma G4643);

c. immobilised on nylon fabric according to the present invention.

Milk decontamination was performed according to the following experimental procedure.

The presence of salmonella antigens in the food liquid was assayed by competitive ELISA, with a specific antibody attached to the microplate and analysis of the competition, for antibody bonding, between the antigen present on the sample and the same antigen conjugated with a detecting enzyme (peroxidase).

A milk lot was added with salmonella antigens up to a final concentration of 20 µg/l and then subdivided into 10 l aliquots, which were treated as follows:

aliquot No. 1: under stirring at 150 rpm, with addition of free – non-immobilised – salmonella anti-antigen specific IgGs in a ratio of 1 mol IgG to 1 mol antigen present;

aliquot No. 2: under stirring at 150 rpm, with addition of anti-antigen specific IgGs immobilised on glass microspheres in a ratio of 1 mol IgG to 1 mol antigen present;

aliquot No. 3 under stirring at 150 rpm, with addition of anti-antigen specific IgGs immobilised on nylon fabric in a ratio of 1 mol IgG to 1 mol antigen present.

All decontamination experiments were carried out at room temperature.

After 3-h contact, the IgGs were removed from the liquid according to the following procedure:

aliquot No. 1 (free IgGs) by filtration through 0.45 µm membrane;

aliquot No. 2 (IgGs on glass microspheres) by filtration through Watmann 1 filter paper;

aliquot No. 3 (IgGs on nylon) by simple removal of the fabric from the liquid.

The antigen residue, if any, in milk was measured.

The results expressed as per cent abatement of the antigen concentration in milk (decontamination power of variously immobilised immunoglobulins) are shown in

Method	% antigen abatement after 3 h
Free IgGs	80
IgGs on glass microspheres	72
IgGs on nylon	100

The above results essentially show the decontamination power of IgGs immobilised on nylon fabric in respect of other immobilisation systems.

The glass microspheres or the nylon fabric were regenerated by removal of the contaminant bound to the antibodies through a 30-min treatment with a 0.1N HCl solution under gentle stirring. The fabric or the microspheres were rinsed with PBS and used in successive decontamination processes according to the procedure described above.

No experiment was carried out with non-immobilised IgGs since they are hardly recoverable.

The following table shows the results obtained in successive treatments; they are expressed as per cent abatement of milk contamination from salmonella antigen.

Method	% antigen abatement after		
	3 treatments	7 treatms:	10 treatms:
IgGs on glass microsperhes	67	52	45
IgGs on nylon	100	100	95

The results obtained show that the immobilisation on nylon surprisingly gives better results than other immobilisation systems, in terms of decontaminant regeneration and re-use. It follows that the incidence of the decontamination costs on the product cost is considerably reduced.

Example 19

Milk decontamination from progesterone

The aim of the experiment was to evaluate the capacity of the immunoglobulins

milk (decontamination power of anti-progesterone specific IgGs immobilised on various inert supports).

Method	% progesterone abatement after	
	1 h	3 h
IgGs on magnetised microspheres	74	88
IgGs on nitrocellulose	97	100

The results point out the decontamination efficiency of IgGs conjugated to fabrics other than nylon, e.g. nitrocellulose.

They also show that, by operating on large quantities, the immobilisation on fabric gives significantly better and more profitable results than the immobilisation on magnetised microspheres.

Example 20

Fruit juice decontamination from atrazine

The aim of the experiment was to analyse the capacity of specific IgGs immobilised on an inert phase for the decontamination of thick food liquids, such as fruit juices, from chemical decontaminants, such as for example atrazine.

To this end, anti-atrazine IgGs were immobilised on:

a. glass microspheres (Sigma 4643),

b. nylon fabric, according to the present invention.

Fruit juice decontamination was performed according to the following experimental procedure.

The atrazine content in fruit juices was evaluated by gas-chromatography according to common methods (H.M. Stahr, Analytical Methods in Toxicology, 1991, pag. 181, John Wiley and Sons, N.Y).

An orange juice as found in commerce was added extemporaneously with an atrazine solution up to a final concentration of 50 µg/l juice.

The juice was subdivided into 5 l aliquots, which were treated as follows:

aliquot No. 1: under stirring at 150 rpm, with addition of anti-atrazine specific IgGs immobilised on glass microspheres in a ratio of 2 mol IgG to 1 mol contaminant;

CLAIMS

1. Membrane consisting of a biocompatible polymer, for decontamination of food liquids from chemical and/or biological contaminants characterized in that said polymer is in the form of woven or non-woven fabric and in that antibodies specific for said contaminants are covalently linked to the membrane.

2. Membrane as claimed in claim 1 wherein said polymer is chosen in the group consisting of: nylon, cellulose, polyacrylates, polyester, polypropilene, their derivatives and mixtures thereof.

2. 3. Membrane as claimed in claim 2 wherein said polymer is nylon, cellulose and derivatives thereof, and wherein said antibodies are linked to the memebrane through a linker selected from the group consisting of: $-CH_2-CH_2-SO_2-CH_2-CH_2-NH-(CH_2)_4-N=CH-(CH_2)_3-CH=O$ or a peptide comprising a diamino-monocarboxylic amino acid or a monoamino-dicarboxylic amino acid.

4. Membrane as claimed in claim 3, wherein the diamino-monocarboxylic amino acid is chosen between Arginine and Lysine and the monoamino-dicarboxylic amino acid is chosen between Glutamic Acid and Aspartic Acid.

5. The membrane as claimed in claims 1 to 4, wherein said contaminants are chosen in the group consisting of: parasiticides, weed-killers, pesticides, drugs and metabolites thereof, hormones and metabolites thereof, wine malolactic fermentation products, and toxins.

6. The membrane as claimed in claim 5, wherein said contaminants are chosen in the group consisting of: atrazine, aflatoxin, ochratoxin, fumonisine, cadaverine, putresceine, urethane, progesterone and salmonella antigen.

7.The membrane as claimed in claim 3, wherein said biocompatible polymer is nylon 66.

8.The membrane as claimed in any of claims 1 to 7, wherein said antibodies are polyclonal antibodies.

9. Process for the decontamination of a food liquid from one or more chemical and/or biological contaminants, based on the contact of said liquid with a membrane consisting of a biocompatible polymer and wherein antibodies specific for said contaminants are covalently linked to said membrane or to the membrane surface.

10. The process as claimed in claim 9 wherein the said contact takes place by

cellulose, polyesters, polyacrylates their derivatives or mixtures thereof for decontamination of food liquids. .

24. Use of membranes as claimed in claim 23 wherein said use consists in a contact by immersion of said membranes in the liquid to be decontaminated.

25. Use of membranes as claimed in claim 24 wherein the said contaminants are chosen in the group consisting of: parasiticides, weed-killers, pesticides, drugs and metabolites thereof, hormones and metabolites thereof, wine malolactic fermentation products, and toxins.

26. Use of membranes as claimed in claim 26 wherein the said contaminants are further chosen in the group consisting of: atrazine, aflatoxin, ochratoxin, fumonisine, cadaverine, putresceine, urethane, progesterone and salmonella antigen.